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Nutritive Values of Food Page 5

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Our Cornucopia

Turkey's on the table, friends all gathered round;
Pies are in the oven, gettin' golden brown.

A time of thanksgiving—this November day—a time to be grateful for our cornucopia with its wide variety of nutritious foods.

This variety is well illustrated in a recent tabulation by ARS nutritionists of 75,000 nutritive values for more than 2,400 U.S. foods (see page 5).

Beyond pointing up abundance, these food values serve as guidelines to those charged with safeguarding our health through proper diets. They are used extensively by nutritionists and dietitians, the medical profession and food industries, and educational institutions and Government agencies.

These tabulations reflect significant changes in the foods making up our cornucopia. Bread, for example, has more calcium, and broilers have less fat. Some of the changes have resulted from improved farming and processing practices; others have been brought about by the efforts of scientists to meet the dietary needs of today's consumers.

But even with our diverse and plentiful food supply, there is no room for complacency. A cereal leaf beetle this year infested 115,500 acres of wheat, oats, and barley in 85 counties of Indiana, Michigan, and Ohio. And a virus complex of corn—the Nation's most valuable grain crop—appeared in the South and is now invading the Cornbelt. Nearly a million acres of U.S. corn was infected this year.

Heavy infestations of the cereal leaf beetle have been treated, and quarantines have been set up to prevent its spread.

Scientists now are (1) searching for strains of small grains and corn with built-in resistance to these pests, (2) seeking parasites and predators that will control the beetle, and (3) determining how the virus is transmitted in corn as a means of finding a method of control.

These are serious threats—but we will meet them as we have similar ones in the past—through research.

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Orville L. Freeman, Secretary,

U.S. Department of Agriculture

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Agricultural Research Service

's still experimental, but a retardant looks promising in . . .

Dwarfing Fruit Trees

ARS scientists have used a growth tardant to control the size and in- ease the flowering of apple, pear, d sweet cherry trees.

This retardant—N-dimethyl amino ccinamic acid—has been widely ed to control the growth of annual d perennial ornamentals. But it is perimental as a spray for fruit trees d has not been recommended or gally approved for use by fruit grow- s.

Studies by horticulturists L. P. ıtjer and M. W. Williams and plant ıysiologist G. C. Martin have been ıderway for 2 years at Wenatchee, ash., in cooperation with the Wash- gton Agricultural Experiment Sta- ons. The scientists plan to measure e accumulative effect of the retard- ıt on fruit trees over a period of veral years.

They will also study the full effects the growth retardant on the fruit self.

Apple trees treated with the chemi- l as a foliar spray had 2 to 12 times many flowers as untreated trees. ew shoot growth of the untreated ees greatly exceeded that of the eated ones—by as much as 50 per- nt.

The scientists found that foliar ray applied on apple trees several ays after full bloom even improved ıe storage quality of the fruit. The eatment prevented development of ald—a serious condition that ap- ears on fruit after removal from orage—and significantly extended ıe shelf life of the fruit. The treated fruit was firmer than stored untreated fruit and softened at a slower rate when removed from storage.

By controlling the growth of fruit trees. orchardists could plant more of the smaller trees in a given area and increase total fruit production.

Nurseries commonly graft commercial fruit varieties on dwarfing rootstocks to prevent the trees from growing to normal size. Some of these rootstocks, however, are known to be infected with viruses and other diseases which will infect any stock grafted to them.

Fruit of the retardant-treated apple and pear trees tended to be smaller than normal for the varieties studied. Tests indicated that this development might be overcome, however, by lower concentrations of the retardant. Smaller fruit could be an advantage especially if it meant a larger percentage of fruit of average size. In some years more large fruit is produced than consumers want.

The scientists say the chemical retardant might also be used to increase flowering of fruit trees in normally unproductive years. Some varieties of fruit have a tendency to overbear one year and, as a result of using up energy reserves, underproduce the following year.

The Wenatchee studies support earlier findings that the growth retarding effects of the chemical remain in a treated plant beyond the first season. Spray treatments applied in 1962 significantly reduced shoot growth the first 2 weeks in 1963.☆

Treated trees had 2 to 12 times as many blossoms as the untreated trees—a beneficial side effect confirmed in the dwarfing studies.

ADDED LIFE for Cut Flowers

Flowers last longer when stored first in nitrogen, tests show

Daffodils held in nitrogen atmospheres (blooms 2 and 3) ha longer display life than those held in air (bloom 1).

■ How do you extend the display life of cut flowers?

The answer, which florists and consumers alike would welcome, may come out of ARS research at Beltsville, Md. In recent tests, scientists prolonged the display life of cut daffodils by storing them in 100-percent nitrogen prior to display.

Plant physiologists Sam Asen and N. W. Stuart and horticulturist C. S. Parsons used King Alfred daffodils in the research.

How much the nitrogen extended display life depended on the storage temperature and the length of the storage period. Daffodils stored in nitrogen for 3 weeks at 32° F., the usual commercial storage temperature, had a display life of 125 hours against 85 hours for those stored in air under similar conditions.

Even at high storage temperatures, nitrogen increased the display life if the storage time was shortened; daffodils kept 2½ days in nitrogen at 70° lasted 88 hours after removal, while those kept in air lasted only 24 additional hours.

Display temperatures were maintained at an average of 72–75°, and display life was measured from the time the flowers were removed from storage to the first sign of deterioration of the daffodil trumpets. In the nitrogen atmosphere, oxygen was eliminated and carbon dioxide accumulation was minimized. Thus, carbon dioxide, which is known to have a beneficial effect on preserving some perishables, was not a factor

In effect, the researchers say, ni gen "anesthetizes" the cut daffodil a process that has been effective periods exceeding 3 weeks. Daffo stored at 40° in nitrogen for as l as 3 weeks had a display life of 9C 100 hours—equal to that of fres cut flowers.

Much more research must be d to determine what commercial ap cation can be made of the gas stora method. So far, daffodils are the o flowers that have responded favoral to the nitrogen atmosphere; howev roses responded to ethylene oxide previous tests (AGR. RES., Janua 1964, p. 14). Controlled atmosphe have been used in the storage of fru and vegetables for some time.☆

Nutritive Values of Food

rgest reference ever compiled lists 75,000 values for 2,400 foods

The most comprehensive reference rk ever published on the nutritive lue of foods—75,000 values for re than 2,400 foods—has been mpiled by ARS nutrition analysts. The nutritional values, derived by rnice K. Watt and her research ff at Hyattsville, Md., are based on views of worldwide scientific and hnical literature, as well as many published reports. Presented in ular form, the food values serve standard references in government encies and for nutritionists and ditians. They also are used widely the medical profession, educational stitutions, and food industries.

The 75,000 nutritional values represent, as closely as possible, the contribution each food makes on a year-und, nationwide basis. They take to consideration, for the first time, ch influences on nutritive value as op variety, market grade, and prossed form of the food.

The new reference—latest revision a series of USDA food composition bles—provides data for 17 constitnts in 2,483 foods and for 5 additional nutrients in more limited lists food. In 1950, by contrast, the searchers could tabulate comprensive data for 15 constituents in nly 751 foods.

Values have now been determined r additional foods of tropical or mitropical origin; for many relavely new forms of common foods, specially the convenience foods; and r many home-prepared cooked ods. Data for fruits, vegetables, nd meats have been greatly extended number and detail, and their nuitive values have undergone major evision.

The number of citrus foods, for nstance, has been expanded from 17 to 73. Values exist now for 51 fresh and processed forms of oranges and grapefruits and for 22 other citrus foods, including lemons, limes, tangerines, tangelos, and kumquats.

The revised values for important nutrients, such as ascorbic acid in oranges, grapefruit, and tangerines, represent more closely the values found in fresh fruit marketed during the entire season. Behind some of these values—like ascorbic acid in tomatoes—are hundreds of analyses.

Improved methods in the production and processing of foods have a significant bearing on changes in composition. Today's young pan-ready fryers have less fat, more water, and a lower calorie value than the fryers of 20 to 40 years ago. The calcium content of most white bread today is nearly three times that of white bread of the 1920's.

To determine composition of foods, the nutrition analysts study data from a vast number of published and unpublished sources. They then derive nutritive values which reflect various influences on the content of the most important nutrients in each product. The value set for vitamin A in sweetpotatoes, for example, represents an average of the most popular varieties; the value for ascorbic acid in white potatoes takes into consideration the maturity and length of storage; the average vitamin A value for butter reflects the season and the area in which it was produced; and the value for ascorbic acid in oranges considers the production site, variety of orange, and date of picking. Important nutrients in other foods may also be influenced by many other conditions.

The values are published in the 190-page Agriculture Handbook No. 8, "Composition of Foods—Raw, Processed, Prepared." The Handbook is available for $1.50 per copy from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402.☆

Are Sugarbeets and Corn Incompatible?

Scientists at Prosser, Wash., find that corn following sugarbeets is zinc deficient

Within recent years, farmers in many areas of the United States have reported that corn following sugarbeets in a crop rotation is yellow and stunted, with symptoms typical of zinc deficiency.

Experiments by an ARS scientist have shown that this corn suffers from zinc deficiency induced by the growing of sugarbeets and not by some difference in management practice.

L. C. Boawn established this fact in research at Prosser, Washington, in cooperation with the Washington Agricultural Experiment Stations.

Boawn says that sugarbeets apparently cause chemical changes in zinc that make it less available to plants. When a zinc-sensitive crop such as corn follows sugarbeets in the crop rotation, it may not get enough zinc for normal growth.

Exactly how sugarbeets change zinc to make it unavailable is not yet understood, but the answer to this question is being sought in studies now underway.

Zinc deficiency has been an increasing problem throughout the United States in recent years. Many farmers regularly fertilize with zinc to prevent crop damage—and this widespread practice undoubtedly has prevented much beet-induced deficiency in corn that otherwise would have occurred, ARS soil scientists say.

Boawn obtained proof that corn suffers from a beet-induced zinc deficiency in a 4-year experiment involving four cropping and fertilizer treatments:

1. Growing sugarbeets 3 years and corn the fourth year.

2. Applying zinc fertilizer prior to growing sugarbeets for 3 years and growing corn the fourth year.

3. Growing grain sorghum for 3 years and corn the fourth year.

4. Applying zinc fertilizer prior to growing sorghum 3 years, and growing corn the fourth year.

Zinc sulfate was broadcast at the rate of 10 pounds per acre and rototilled to a depth of 8 inches.

Boawn removed all crop residue from the sugarbeet plots the first year; but in the second and third years, he removed tops from only half of each sugarbeet plot. He removed all residue every year from each sorghum plot. And then before planting corn in the fourth year of the experiment, Boawn took soil samples to determine how much zinc had been removed by 3 years of cropping with sugarbeets and sorghum.

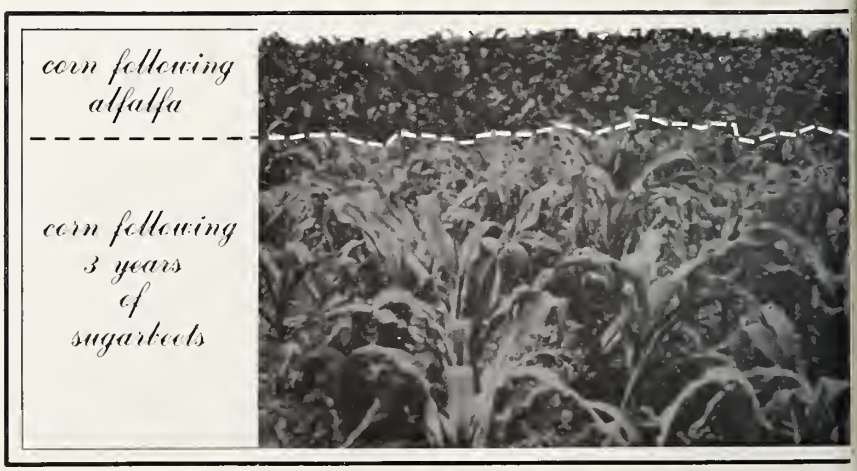
By the time the corn was 6 to 8 inches tall, typical stunting and chlorosis symptoms of zinc deficien were evident on the plots on whi sugarbeets had been grown but th had not been fertilized with zinc. I zinc deficiency occurred in corn f lowing sorghum or in corn followi sugarbeets in plots that had been f tilized with zinc.

These results provided concrete e dence that stunting and yellowing corn were caused by zinc deficien induced by sugarbeets.

Boawn says the deficiency in l tests cannot be attributed to exc phosphorus, often blamed for zi deficiency in corn; he made sma uniform phosphorus applications.

Although there was some indicati that the deficiency was more sev where beet tops were returned to t soil, this practice was not the s cause of deficiency. A definite zi deficiency existed in corn grown plots where tops had been removed.

Since soil analyses showed th sugarbeets removed no more zi from the soil than grain sorghum d the deficiency was not caused by cess removal of zinc by sugarbeets.



Corn in the foreground has typical stunting and chlorosis symptoms of zinc deficiency, contrasting sharply with that in the background.

Corn earworm larva fed on pieces of filter paper treated with feeding stimulant. It did not feed on the filter paper that had been treated only with distilled water.

What makes the earworm feed on corn?

■ The substance that makes corn appetizing to the earworm, one of the most destructive and widespread pests of corn. has been extracted from silks and fresh kernels by ARS scientists at the Southern Grain Insects Investigations Laboratory, Tifton, Ga.

Earworms eagerly ate filter paper that had been soaked in a solution containing the feeding stimulant.

This investigation is a part of ARS research at several U.S. locations where scientists are extracting and studying natural plant chemicals that affect insect behavior. The extracts are generally classified either as feeding stimulants—like that from corn—or as attractants, repellents, or ovipositional (egg-laying) stimulants.

The scientists think it may be possible to identify and synthesize plant chemicals that can be developed as new pest-control methods. One possibility would be to control the corn earworm by using an attractant to draw the pest to a poisoned bait that has been made appetizing by the feeding stimulant.

Another would be to develop crop varieties that contain a high concentration of repellent or low concentrations of attractant and feeding and ovipositional stimulants.

Entomologists K. J. Starks, W. W. McMillan, and H C Cox and chemist A. A. Sekul participated in the Tifton research on the corn earworm, which, along with its close relatives, occurs in all parts of the world where corn is grown. It is easily the most destructive pest of sweet corn in the United States.

Although the chemical nature of the corn feeding stimulant has not been determined, the scientists know it is soluble in water. They obtained water extracts containing the substance from silks and fresh kernels after fixing the tissue in ether, alcohol, or by freezing. The substance was not present in extracts made with ether or alcohol.

The next research steps will be to identify the substance chemically and then synthesize it.

The scientists determined the effect of the earworm feeding stimulant by placing larvae in dishes containing two pieces of filter paper impregnated with plant extract and two pieces of filter paper impregnated with distilled water. In each feeding-response test, a larva was allowed to roam and feed indiscriminately in the dish for about 18 hours. Scientists then removed the pieces of filter paper and determined the area that had been consumed.

Feeding response to filter paper treated with the water-soluble plant extract was 13 to 29 times as great as response to the filter paper treated with plain water.

The entomologists point out that the response to the stimulant apparently was correlated directly with the concentration; there was little response to extract diluted 20 times. There was no feeding response to extracts of the plant material made with ether or alcohol.

In addition to testing the three extracts, the scientists also evaluated feeding responses to filter paper impregnated with eight sugar solutions. Since the total area of the paper eaten in the sugar tests was appreciably less than in the water-extract tests, the researchers say that the substance in the stimulant that caused them to feed probably was not sugar.☆

Dead larvae of the cotton bollworm—loaded with virus polyhedra—are processed to obtain a virus suspension. In tests, this suspension is then sprayed on cotton with available field equipment to control cotton bollworms.

Far more cotton blossoms, squares, and bolls were collected from three virus-treated plants (right) than from three untreated plants (left). The fruiting forms all came from cotton plants selected at random in field plots.

An ARS entomologist at B develops a way to mass pro

NATURAL

■ Use of insect viruses as natural insecticides may be one of the most promising advances yet made in the fight to control pests by biological means.

A method of mass producing some of these viruses has been perfected by ARS entomologist C. M. Ignoffo, Brownsville, Tex. This, in turn, could place them within reach of most farmers at a reasonable cost.

Brownsville scientists have mass produced several insect viruses, including one that infects the cotton bollworm, *Heliothis zea*, and the tobacco budworm, *Heliothis viriscens*. Continuing research may find that many of the nearly 200 known viruses that attack specific insects can be produced in this way.

Virus develops in cell nucleus

Both the cotton bollworm (also called the tomato fruitworm—and the corn earworm) and the tobacco budworm can be infected with a virus of the nuclear polyhedrosis type. This virus develops in the nucleus of a living cell, where it multiplies and prevents the cell from performing normal functions. Clusters of rod-shaped virus particles in the nucleus are eventually enclosed in a protein covering, forming a tough, many-sided body (the polyhedron).

In the virus production method developed at Brownsville, scientists feed the polyhedra to first-stage larvae of the bollworm and budworm. The larvae are reared individually (because they're cannibalistic) on a synthetic diet in closed 2-ounce plastic cups.

Virus Multiplies up to 10,000 times

Polyhedra in the larvae multiply at an almost unbelievable rate. One larva produces anywhere from 6 to 24 billion polyhedra—representing a minimum increase of 1,000 to 10,000 times the amount of virus originally injected into each larva cup. The polyhedra eventually kill the larvae, which then are processed to obtain a virus suspension for spraying on field crops.

The virus produced in only 100 larvae will treat an

le, Tex.,

NSECTICIDES

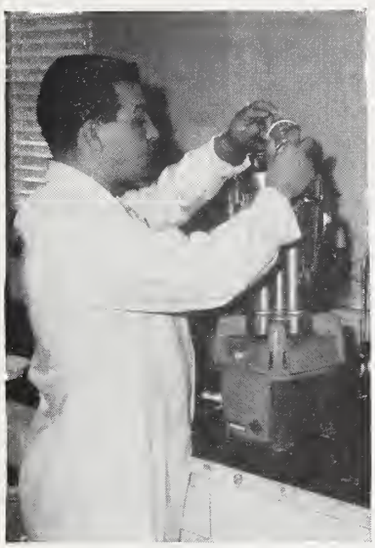
Rod-shaped virus particles, magnified 40,000 times, are visible in this polyhedron of cotton bollworm virus.

entire acre of farmland. Insects on the treated crops consume the virus, become infected, and produce new virus. When infected insects die, virus in their bodies can disperse and kill other worms. Although wide dispersal also occurs in this manner in nature, the infection isn't always timed to prevent plant damage. Accordingly, scheduled spray applications of virus are necessary to insure that pests "catch" the disease before they have already destroyed a crop.

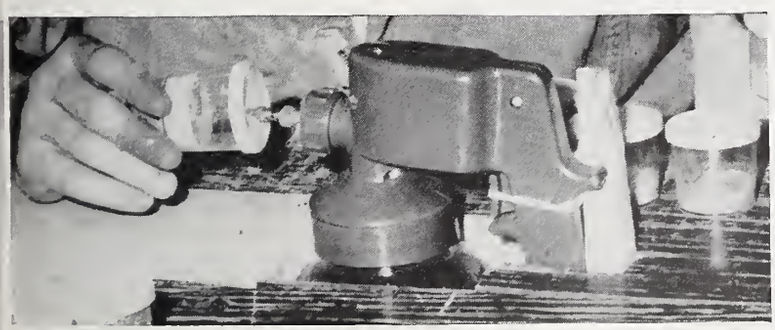
Research has shown this virus to be highly selective—infecting only the target insects. It thus poses no danger to beneficial insects, animals, or man.

The polyhedra material can be freeze-dried under vacuum and refrigerated from one season to the next.☆

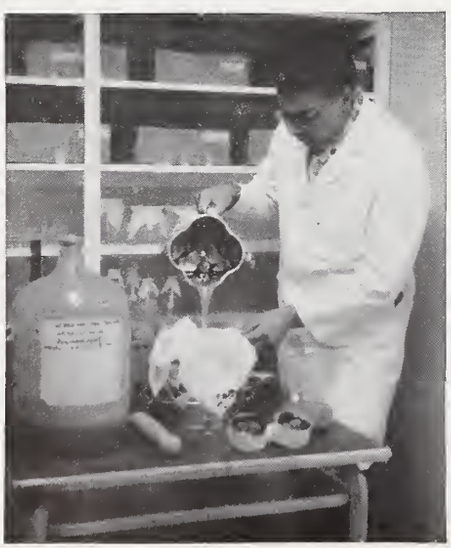
RIGHT—A semi-synthetic diet used to rear bollworms and tobacco budworms is made in gallon-size blenders. One batch is enough for 140 rearing cups or 350 virus-propagation cups.



FAR RIGHT—The hot liquid diet is dispensed into 2-ounce plastic rearing cups, fitted with flexible polyethylene lids.



Once the larvae have been placed in rearing cups, and lids put on, a virus-inoculating-apparatus is used to spray each larva with the virus suspension. Two men can inoculate about 2,000 cups an hour.



In preparing the virus for use in field application, diseased larvae are blended with water, then passed through a 1/44-mesh cheesecloth sieve. The preparation is standardized to equal one larval equivalent for each milliliter of virus suspension.

CORING THE SOIL

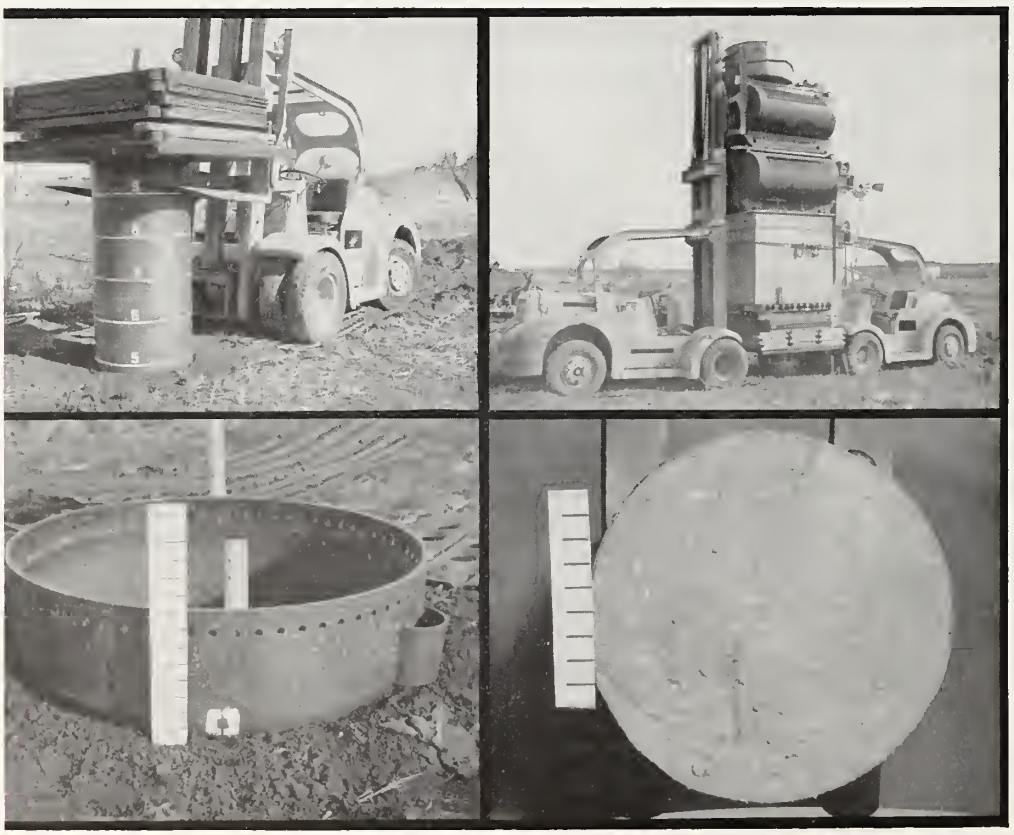
Scientists develop a research tool to obtain giant cores more easily

A method that saves time and labor in removing huge cores of undisturbed soil from the ground has been developed by ARS scientists at Temple, Tex., as a supporting procedure in basic soil research.

Cores are used in studies of moisture flow, transpiration and evaporation, and root systems, and in a score of other investigations requiring large volumes of the undisturbed soil. The ability to secure such large cores is thus of prime importance in soils research.

The new method of obtaining cores involves pressing steel cylinders into the earth with weights, then lifting the cylinders out of the ground with soil intact. Scientists report they can obtain columns to 9 feet in depth and 16 to 38 inches in diameter—in only 3 or 4 hours.

Soil scientists J. L. Tackett and Earl Burnett and agricultural engineer D. W. Fryrear, all of ARS, conducted the research in cooperation with the Texas Agricultural Experiment Station.



LEFT—A static weight of 15,600 pounds was needed to press the coring cylinder 5 feet into Houston Black clay. RIGHT—The weight was increased to 52,000 pounds to press the cylinder 9 feet into the clay.

LEFT—Comparison of the soil inside and outside of the cylinder shows that compaction in the core is slight. RIGHT—This 16-inch core had a smooth plane of breakage at a depth of 5½ feet. Dark streaks are surface soil that had silted through old shrinkage cracks.

They used a fork lift to load heavy weights onto standing cylinders, thus pressing them into the ground. The weights vary with the size of the cylinder, the type of soil being cored, and the depth desired.

The researchers found, for example, that a weight of 22,700 pounds was enough to press a 26-inch cylinder into Houston Black clay to a 6-foot depth. A 28.5-inch cylinder needs 15,600 pounds of pressure to reach 5 feet and 52,000 pounds to reach 9 feet.

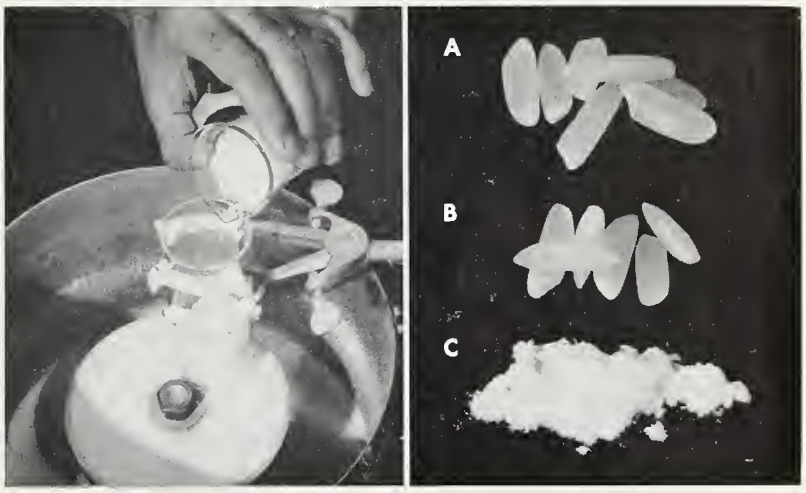
Various kinds of weights were used including steel plates, 600-gallon metal water tanks, and 5-foot-square steel boxes filled with washed gravel. For added weight, water was pumped into the tanks and the boxes of gravel, after they had been loaded onto the cylinder.

The lower end of the cylinder is bevelled around the outside edge to aid in cutting through the soil. This edge also serves to displace the soil to the outside of the cylinder wall, thus reducing soil compaction in the core.

In all the tests, the soil profile remained undisturbed in the cylinders when they were removed from the ground with the fork lift, and compaction of earth inside the cylinders was insignificant.

Although only Houston Black clay was used in the Temple tests, scientists anticipate that the procedure will work on a wide variety of soils.☆

Rice tumbles against a rapidly-moving abrasive in this small-scale deepmiller. Milled rice (A) was used in the tests, resulting in slightly smaller residual kernels (B) and the protein-rich flour (C).



Deepmilling of RICE

Yields high protein flour and a whiter grain

■ A rice-milling process now under development by ARS scientists may result in a high-protein rice flour and whiter, more attractive rice.

The high-protein flour could be an important new outlet for rice—as an ingredient in baby foods and special diets for all ages—since rice is generally considered easily digested and nonallergenic. The rice flour might also be suitable for making special high-protein foods in countries where there is a lack of protein, particularly in diets of children.

The new process, called deepmilling, was developed by ARS chemists J. T. Hogan, F. L. Normand, and H. J. Deobald, after scientists in Spain reported that protein content of rice is highest in the outer portions of the kernel and decreases toward the center. (The Spanish research was financed by a grant awarded by USDA under Public Law 480.)

The three ARS chemists theorized that a small percentage of the outer portion of rice kernels could be removed as a protein-rich flour, leaving the residual kernels as a white rice suitable for food uses.

Working at the Southern utilization research laboratory, New Orleans, the chemists designed a small-scale deepmiller to tumble rice against a rapidly moving abrasive that grinds away the outer surface. The milled flour has as much as 20 percent protein, compared with 6 to 9 percent in the entire kernel before the outer portion was removed. The residual kernels were chalky white, and tests showed that they cooked the same as rice that was milled normally.☆

Taking the guesswork out of designing systems for . . .

Sprinkler Irrigation

ARS engineers have developed equipment and procedures that should take the guesswork out of designing a sprinkler irrigation system to fit conditions on a given field.

The more accurate design is based on (1) an experimental device, called a springler infiltrometer, for measuring the water-intake rate of soil to be irrigated with sprinklers; and (2) a simplified, accurate way of selecting equipment and operating specifications best suited to individual fields.

The soil's water-intake rate determines how fast a farmer can safely apply water with a sprinkler. But, in the absence of accurate intake information, designers of sprinkler systems often must rely on estimates based on soil texture and observation of other sprinklers operating nearby.

The infiltrometer (see photo) is a trailer-mounted device that can be taken to farmers' fields for soil-water-intake determinations. ARS irrigation engineers Rhys Tovey, Reno, Nev., and C. H. Pair, Twin Falls, Idaho, designed the equipment in cooperation with the Nevada and Idaho Agricultural Experiment Stations.

The infiltrometer consists of a water-supply tank, a sprinkler head that rotates inside a slotted circular shield, pumps for delivering water to the sprinkler and returning excess water to the supply tank, plus necessary hoses, valves, and gages. A vertical slot in the side of the shield allows water from the nozzle to spray on a pie-shaped section of the field (one-eighth of a circle), falling in this area as it would from a normally operating sprinkler system.

Operation of the sprinkler infiltrometer is as follows:

1. One or more sites are selected where soils are typical of major areas of the field to be irrigated.

2. Soil moisture at the test site is brought to field capacity, the highest amount of moisture the soil will hold under conditions of free drainage. At this point, the intake rate approaches its lowest level.

3. Three 1-quart cans are spaced a few inches apart every 5 feet along the entire length of the stream of water (see photo).

4. The sprinkler infiltrometer is operated at least an hour, during which time the operator observes whether the application rate near each can is too high, just right, or too low.

After the equipment has been turned off, the operator measures the water in each can and calculates the intake rate per hour. Based on these calculations and his observations, he selects the optimum intake rate for use in designing the irrigation system.

Sprinkler system designing will also be more accurate and less time-consuming. Pair says, by using a procedure he proposes for selecting the sprinkler head, nozzle size, operating

The portable sprinkler infiltrometer irrigates a pie-shaped portion of a field on which soil moisture had been brought to field capacity.

An irrigation engineer measures the amount of water collected in quart cans, then calculates the soil's rate of intake per hour.

pressure, distance separating sprinkler heads on the lateral lines, operation time of the lateral at each "set" or location, and distance the laterals should be moved.

Pair suggests making trial runs of available equipment under all logical combinations of these six points. Then draw, and make available to designers, graphs that show the application and accumulation patterns for the various combinations.

Under Pair's procedure, the designer would first measure the soil's water-intake rate and decide, from soil and crop requirements, the amount of water that should be applied at each irrigation.

He would then select the application graph representing the combination that would apply water no faster than the intake rate on 90 to 95 percent of the area. This graph directs the designer in his choice of sprinkler head, nozzle size, operating pressure, and spacing of heads on the lateral.

Finally, the designer would determine the distance the lateral is to be moved and the operating time of the lateral. These are obtained from the water *accumulation* graph that corresponds to the water *application* graph previously chosen. The water accumulation graph, developed by testing two sprinkler laterals operating simultaneously, could also be used in evaluating how good an irrigation job could be done with the system.

Sprinkler manufacturers and agricultural engineering technical groups are considering adoption of the new design procedure. The sprinkler infiltrometer is not yet commercially available.☆

Yellow-poplar seedlings were rooted in 3 to 4 weeks from stump sprouts. Of all sprouts started, 80 to 100 percent took root and grew.

ROOTING POPLARS

Scientists root cuttings from stumps

After trying unsuccessfully for years to root yellow-poplar cuttings, scientists at the Forest Service's Southeastern Forest Experiment Station, Asheville, N.C., have found the answer: Take cuttings from stump sprouts instead of from tree limbs.

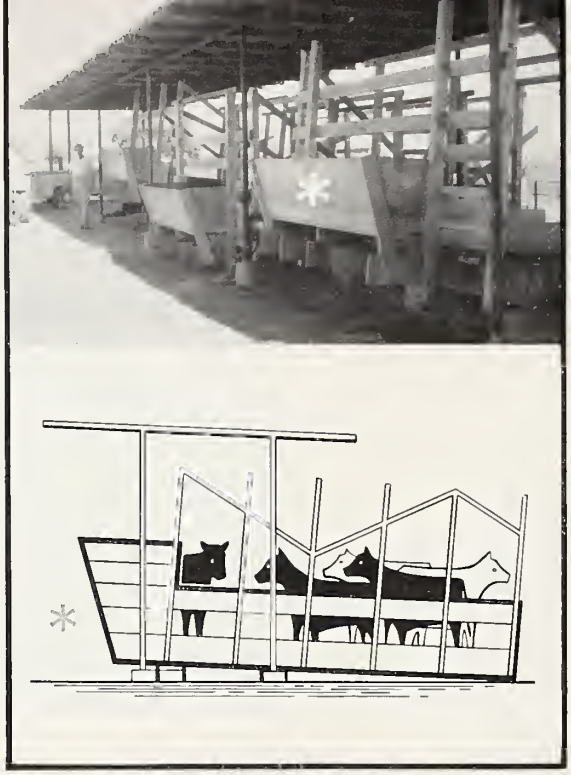
Cuttings from yellow-poplar stump sprouts took root, grew, and transplanted easily in experiments conducted early in the spring of 1963 and 1964. The stump sprouts were made into cuttings and placed in rooting beds; in 3 to 4 weeks, 80 to 100 percent of the cuttings developed roots.

Previous studies of cuttings taken from tree limbs had been discouraging. In extensive Forest Service tests at Oxford, Miss., substances used to bring about root formation—indolebutyric acid, indoleacetic acid, and naphthaleneacetic acid—had failed to induce rooting of yellow-poplar cuttings taken from tree limbs.

Of 1,650 limb cuttings planted in those experiments, only one rooted—and it was an untreated check. With this single exception, no difference could be told between cuttings that had been soaked in root-stimulating solutions and those that had not.

The cuttings from stump sprouts grew 5 to 5½ feet high in the first 2 months, and they continued to grow rapidly as transplants.

Multiplying a selected tree through rooted cuttings is one of the main tools in tree-improvement research. It is especially important in studying tree nutrition and the relationships of a planting site to the species.☆



Cattle were fed in these experimental feedlots, two of which have tilted floors, and the center one level. The most sueeessful feedlot (see asterisk) had a sloping floor of 4¾ degrees.

TILTED FEEDLOTS

Cattle gain more in pens that are partially self-cleaning

■ Tilted feedlots now being tested in California could be the forerunner of self-cleaning units for beef cattle.

Three experimental pens, 12 by 14 feet, have been built and are being tested by agricultural engineer T. E. Bond of ARS and S. R. Morrison, W. N. Garrett, V. E. Mendel, and C. F. Kelly of the California Agricultural Experiment Station.

The pens have concrete floors and are designed so that each can be tilted—including the floor.

In recent tests. one pen was kept flat, another was sloped 4¾ degrees, and a third was sloped 7 degrees. The feed trough and stalls were located along the high side of the sloped pens (see illustrations).

Five steers—averaging 630 pounds—were placed in each pen for a 186-day test period.

Steers fed on both of the sloping floors outgained those on the flat floor; in fact, those on the 4¾-degree floor gained almost ⅓ pound more per day than those fed on the level.

The researchers have no immediate explanation for this difference in rate of gain. They observed, however, that steers on the flat floor did not lie down as much—spending half again as much time standing—as steers on the sloping floors.

Although the tilted floors were only partially self-cleaning, the scientists say that the flat floors were much dirtier, which may account for the fact that this group of steers preferred to stand more.

The theory that the steers would move manure down the sloping floor as they walked up the incline to the feed trough didn't prove completely true. There may be two reasons for this, the researchers say. First. the pens were shaded, and manure didn't have an opportunity to dry out. Second, waterers were installed inside the pens where they contributed to the moisture problem.

In the next series of tests, pens will be fully exposed to the sun, and waterers will be moved to the outside. The researchers are satisfied, however, that the 4¾-degree slope is the most suitable for self-cleaning.☆

Approved: Calves to Italy by air

Two new methods of shipping U.S. calves to Italy by air have been tested and approved by ARS veterinarians responsible for seeing that all animals exported from the United States are free from disease and handled in a humane manner.

Interest in the new industry-developed shipping methods was created by a demand for young calves (less than 2 weeks old) to be fed out and slaughtered for veal in Italy. A current shortage of such stock in Europe led the Italian government to authorize duty-free importation of up to 100,000 calves by the end of 1964.

One method of air shipment consists of placing three calves in a slatted carton. The cartons are then double-decked and handled on cargo pallets, which are placed in regular jet airliner cargo compartments. ARS veterinarians determined that this method provides sufficient space and ventilation for the livestock during the 8- to 10-hour flight. They then authorized a test shipment of three calves, which arrived in Europe in good condition. Regular commercial shipments were authorized, and 60 calves were shipped in crates as the first full-scale commercial flight.

The second method involves placing a dozen or more calves in each of several lightweight, plywood pens constructed in an airplane. In an initial test shipment, 280 calves traveling in pens on a DC–7 arrived in excellent condition. During the 2 weeks following the test shipment—additional U.S. calves were flown to Italy in the lightweight plywood pens.

The calves-in-carton method is best adapted for use aboard commercial jet airlines because the cartons can be placed in regular cargo space. The pen method is used when an entire plane is to be loaded with calves. Both the pens and the plane must be thoroughly disinfected before reuse to prevent possible spread of animal diseases. The cartons are disposed of after use and less extensive disinfection of the plane is required.

A first for Vermont: Hog cholera free

Vermont is the first State to be free of hog cholera in the nationwide campaign to eradicate this costly swine disease.

A certificate signed by Secretary of Agriculture Orville L. Freeman, recognizing the State's accomplishment, was presented to Governor Philip H. Hoff of Vermont at a special luncheon celebration in Montpelier. N. C. Brady, USDA's director of science and education, made the presentation on behalf of the Secretary.

Vermont achieved the hog-cholera-free status by systematically carrying out all of the steps in the cooperative State-Federal hog cholera eradication program.

And now regulatory workers are set up to immediately locate and wipe out any hog cholera outbreak which might be introduced from outside the State. By stamping out an outbreak before it has a chance to spread, Vermont can maintain its status as hog cholera free.

A goal of 1972 has been established for officially declaring the entire United States to be hog cholera free. Nationwide eradication of this disease will eliminate a continuing cost to hog producers in the United States of about $50 million each year.

Applying insecticides on stems

Certain systemic insecticides may protect cotton plants more effectively when applied to plant stems rather than to seeds, to the soil, or to the foliage.

Application of systemic insecticides to stems has been limited in the past almost entirely to trunks of trees.

Scientists believe that stem treatments would be less likely to harm beneficial insects than foliar sprays. Although beneficial insects do not feed on the plant, they may come in contact with the plant's leaves. Research is continuing to determine the effect the stem treatment would have on other insects—and the proper timing of the treatment to avoid translocation of the insecticide into the seed.

In laboratory tests at College Station, Tex., scientists applied a commercial insecticide to plant stems in the form of a lanolin paste. The insecticide (3-hydroxyl-N,N-dimethyl-cis-crotonamide dimethyl phosphate), is used extensively on cotton as a foliar spray.

The compound is transferred to other parts of the cotton plant more efficiently from the stem than from either the soil or the seed. When sprayed on leaves, it is absorbed into the leaf surface but is not translocated. ARS entomologists D. A. Lindquist, D. L. Bull, and R. L. Ridgway are conducting the research in cooperation with the Texas Agricultural Experiment Station.

The scientists believe that direct application of systemic insecticides to

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plant stems might lead to better control of insects that attack the fruiting parts of the cotton plant than is possible with other treatments.

The scientists are continuing research on the development of systemic insecticides and the application of these compounds to the stems of cotton plants. They want to find out, for example, whether formulations that would allow slow, constant uptake of systemic insecticides by a plant would reduce the number of applications to the stem necessary for insect control.

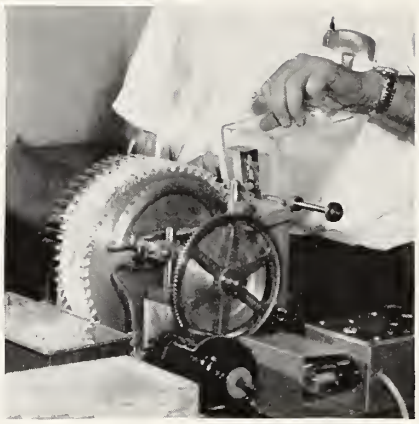
Ingenious unit speeds tube making

Two ARS technicians have designed and built a machine for making glass tubes in which micro-organisms are kept in a culture collection at the Northern utilization research laboratory, Peoria, Ill.

The ARS collection of micro-organisms is the largest in the world devoted to preserving industrially important yeast, molds, and bacteria.

The new machine, designed and built by machinist H. E. Ladd and glass-blower F. J. Castle, can process 3,600 tubes an hour—15 times the manual rate.

In operation, short lengths of glass tubing feed through the unit over a pair of gas burners. One end of each cylinder is melted shut; the other is fire polished. Micro-organisms are put into the tubes and freeze-dried, then the open end is melted shut.



Tubes feed from a plastic hopper into notches on a pair of aluminum "wheels," separated by a stationary drum. As the wheels turn, the glass cylinders—rolling on the drum surface—are carried over a pair of gas burners. One end of each cylinder is melted shut, the other is fire polished.

The ARS collection serves industry as a source of pure cultures for various fermentation processes, in addition to supplying micro-organisms for numerous utilization research studies.

Aids research on pine beetle

Forest Service entomologists have perfected a method for mass-rearing the southern pine beetle at the Southeastern Forest Experiment Station, Durham, N.C.

Before this development, the beetles could not be produced in large enough numbers for a thorough study of the biology of the insect. Such studies often pave the way for new methods of insect control (see "What makes the earworm feed on corn?" p. 7).

Forest entomologists are now investigating the effects of temperature on beetle activity, nutritional requirements of the beetles, and beetle sex attractants. These studies are dependent on a plentiful supply of insects, made possible by mass rearing.

Information is being collected on the beetle's egg-laying capacity, its emergence and breeding habits, and its survival under varying bark moisture conditions. All of these are important in developing ways of controlling the beetle.

Using the new mass-rearing technique, the entomologists place adult southern pine beetles in a metal can with pieces of pine logs. Five days later, they place a collecting jar at the bottom of the can. All light is kept out of the can, and dry air is passed through it to regulate the temperature.

By the end of 20 days, the original beetles have completed mating and egg laying and have been collected in the jar for further study. New-brood adults begin emerging in the jar in 30 days and continue for another 30 days.

Production of beetles is high, and practically all new adults are recovered. For every beetle introduced into a can, 10 new-brood adults emerge—a figure comparable to that in nature during epidemic peaks.

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